An Extension of the Classical Estimates of Dredge Efficiency and Animal Stock Abundance and Its Application to Sea Scallop Fishery in Georges Bank

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ABSTRACT

The Sea Scallop survey data based on depletion experiments recently collected in Georges Bank are not typically generated from the same fishing ground in each tow due to tide, wind and other physical forces in the ocean as well as human error. Under this circumstance, the traditional estimation method is not adequate. Therefore, we formulate an alternative estimation technique based on the geometry of each tow. We first derive the basic identity of catch per-unit effort in a depletion experiment when each tow is not entirely overlapped. Based on this basic identity, four commonly used models in fishery stock assessment are estimated using the maximum likelihood method. The estimated results from these four models, the negative binomial model (also called patch model), the Poisson distribution model, the Gaussian distribution model and the lognormal distribution model, are very robust, yielding virtually the same conclusion regarding the density and dredge efficiency. On the other hand, the estimated results from the traditional approach yield totally misleading conclusions. Various possible directions in the future research along this line are suggested.

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